

REMARKS

INTRODUCTION

In accordance with the foregoing, claims 1, 4 and 7 have been amended. Claims 6 and 11-15 have been cancelled. Claims 1-4 and 7-10 are pending and under consideration.

CLAIM REJECTIONS

Claims 1-3 were rejected under 35 USC 103(a) as being unpatentable over Shi et al. (US 6,746,896) (hereinafter "Shi") in view of Admitted Prior Art (hereinafter "APA").

Claims 4 and 6-14 were rejected under 35 USC 103(a) as being unpatentable over Shi in view of Farnworth (US 6,881,607) (hereinafter "Farnworth").

Shi discusses a process and material for low-cost flip-chip solder interconnect structures. In Shi, a patterned silica wafer 100 is bumped at step AA to produce a bumped wafer 110. Next at step BB, the bumped wafer 110 is coated with a layer of the WLFCU material and the coating is allowed to dry to produce a WLFCU material coated wafer 120. Fluxable liquid silica filled or un-filled WLFCU has a proper viscosity and is uniformly dispensed on an entire bumped wafer 110 using screen printing, spinning coating, curtain coating, meniscus coating, and etc. Then, the WLFCU material is solidified with enough adhesion strength to bumped wafer 110. The thickness of the solid WLFCU material is $\sim 10\text{ }\mu\text{m}$ less than the bump height so that the tip of solder bumps are not covered by the solid WLFCU material. Shi, 5:6-5:19 and Figure 2.

Further in Shi, at step CC the entire solid WLFCU material coated wafer is diced (singulated) into individual chips without damaging the coated WLFCU layer to produce a diced wafer 130. The diced-wafer 140 is then flipped over and placed on a thin layer of fluxable tacky film that is on a carrying film at step DD to produce a flipped wafer 140. The adhesion strength of the fluxable tacky film to the carrying film is designed to be less than to the solid WLFCU layer so that the fluxable tacky film can stick to the WLFCU layer in the later pick-and-place process. After the individual chip is picked, aligned, and placed on a circuit board or substrate at steps EE and FF, the fluxable tacky film can hold the chip to the circuit board and maintain the alignment. Shi, 5:20-5:32 and Figure 2.

Claims 1-3

Amended claim 3 recites: "A method of surface-mounting semiconductor chips on a PCB, including mounting a flip chip type semiconductor chip on the PCB mounted with electronic components, consisting essentially of: forming a solder bump...injecting underfill material...hardening the underfill material... severing the semiconductor wafer into the plurality of the semiconductor chips...arranging the severed semiconductor chips...heating the PCB at a predetermined temperature." In the "Response to Arguments" section beginning on page 7 of the Office Action, the Examiner noted that the term "comprising" is open ended and allows for the inclusion of other elements and that further limitations from the specification are not read into the claims. Claim 1 has been amended to change the transitional phrase "comprising" to "consisting essentially of" and support for this amendment may be found in at least paragraph [0013] of the specification which notes that an aspect of the present invention is that there is no need to use a package to transfer a semiconductor chip in the middle of the manufacturing process. Please see MPEP 2111.03.

In the Office Action, the Examiner relied on Shi to discuss a method of surface-mounting semiconductor chips on a PCB. However, in contrast to claim 1, the method of Shi includes step CC where the entire solid WLCFU material coated wafer is diced (singulated) into individual chips without damaging the coated WLCFU layer to produce a diced wafer 130. Then in Shi, the diced-wafer 140 is flipped over and placed on a thin layer of fluxable tacky film that is on a carrying film at step DD to produce a flipped wafer 140.

In contrast to Shi, claim 1 recites a method of surface-mounting the semiconductor chip having a simplified process that removes the need to have a package for the chip transfer in the middle of the process. As such, it is respectfully submitted that claim 1 patentably distinguishes over Shi.

Claims 2 and 3 depend on claim 1 and are therefore believed to be allowable for the foregoing reasons.

Withdrawal of the foregoing rejection is requested.

Claims 4 and 6-10

Amended claim 4 recites: "A process of preparing a wafer to be used for surface mounting a semiconductor chip on a PCB consisting essentially of: forming a plurality of solder balls... coating the surface of the semiconductor wafer... curing the underfill material... severing the semiconductor wafer... arranging the plurality of semiconductor chips... raising the temperature of the PCB to a predetermined temperature..." Support for the amendment to claim 4 may be found in at least original claim 6 and further, regarding changing the transitional phrase "comprising" to "consisting essentially of" support may be found in at least paragraph [0013] of the specification which notes that an aspect of the present invention is that there is no need to use a package to transfer a semiconductor chip in the middle of the manufacturing process.

In the Office Action, the Examiner relied on Shi to discuss a method of surface-mounting semiconductor chips on a PCB. However, in contrast to claim 4, the method of Shi includes step DD where the diced-wafer 140 is flipped over and placed on a thin layer of fluxable tacky film that is on a carrying film to produce a flipped wafer 140. In contrast to Shi, claim 4 recites a method of surface-mounting the semiconductor chip having a simplified process that removes the need to have a package for the chip transfer in the middle of the process. As such, it is respectfully submitted that claim 4 patentably distinguishes over Shi. Further, Farnworth, which discusses a method for underfilling and encapsulating flip-chip configured semiconductor devices, does not cure this deficiency in Shi.

Claim 6 has been cancelled. Claims 7-10 depend on claim 4 and are therefore believed to be allowable for the foregoing reasons.

Withdrawal of the foregoing rejection is requested.

Claims 11-15

Claims 11-15 have been cancelled.

CONCLUSION

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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Date: April 9, 2007

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